U. S. Railroad Retirement Board

Conceptual Architecture Guiding Principles

Holistic Principles

to Guide the

Railroad Retirement Board's

Domain Architectures

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Version 1.0

Conceptual Architecture Guiding Principles
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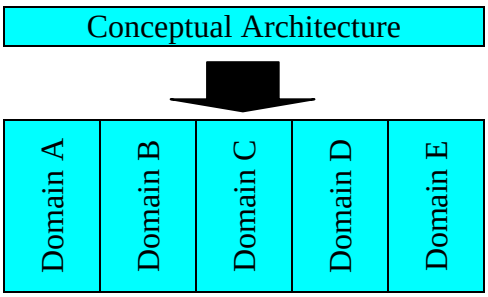
Introduction

The Conceptual Architectural principles for the enterprise wide technical architecture (EWTA) identified in this document, provide a stable foundation upon which RRB Information Technology staff can make important IT system design and implementation decisions. The Conceptual Architecture principles are driven from the business requirements and can be expected to evolve as the RRB's mission and business functions evolve.

The Conceptual Architecture principles describe the foundation assumptions on which the technical architecture Domain Architectures are built and help identify the "soft" gaps between the future and current state.



What are Conceptual Architecture Principles?

Conceptual Architecture Principles form the rules by which basic information management decisions can be made. Principles play a pivotal role in obtaining the results and actions desired, stemming from the values of an organization. Upon reading a principle, a reaction may be that "this is motherhood and apple pie." However, though a principle may seem self-evident, that does not mean that the principle is actually observed by the RRB today even when there are verbal acknowledgments. Adopting the set of principles is expected to initiate a change process for RRB information and technology related policies and procedures to bring them into conformance. Violations of principles in an architected environment generally cause operational problems and can inhibit the ability of the RRB to fulfill its mission.

Merely having a written statement that is called a principle, even if everyone agrees with the statement, does not mean that the principle is good. A good set of principles will fulfill their intended purpose. For the purposes of the RRB's EWTA, the principles will:

- Provide a firm foundation for making the architecture and planning decisions,
- Frame policies, procedures and standards, and
- Resolve contradictory situations.

Criteria for effective principles

There are five (5) criteria that distinguish effective principles. They are:

Criteria	Explanation
Understandable	The underlying tenets of the principles can be quickly grasped and understood by individuals throughout the enterprise. The intention of the principle is clear and unambiguous so that violations, where intentional or not, are minimized.
Robust	Good quality decisions about architectures and plans can be made, with the principles as a base. Enforceable policies and standards can be created. There are no "easy out" exception clauses or expressions. Each set of principles should be sufficiently definitive and precise for deciding complex, potentially controversial situations consistently.
Complete	Every potentially important principle governing the management of information and technology for the enterprise has been defined. The principles are applicable to every situation perceived.
Consistent	Every word in a principle statement should be carefully chosen to ensure consistent interpretation. There may be times, however, when strict adherence to one principle may require a loose interpretation of another principle. For example, access to information may be weighed against ease of use. There must be a balance of interpretations of the principles. Principles should not be contradictory to the point where adhering to one principle would violate the spirit of another.
Stable	Principles should have a "timeless" quality about them, and be able to transcend all foreseeable changes that may occur. The principles for information and technology management need not be changed merely to keep up with technology advancements.

Components of Conceptual Architecture Principles

The RRB's Conceptual Architecture Guiding Principles are made up of four simple components:

Component	Explanation	Example
Name	represents the essence of the rule and is easy to remember.	"Buy or reuse software before building."
Description	communicates the fundamental right or rule clearly and concisely. A principle statement should be unambiguous.	"Buying software packages or reusing existing software is a higher priority than custom building software."
Rationale	explains the importance of the principle and point to the similarity of information and technology principles to the principles governing business operations. The rationale describes the relationship to other principles and the intentions regarding a balanced interpretation. It also describes situations where one principle would be given precedence or carry more weight than another for making a decision. In other words, it convinces somebody else that it is a good idea.	1. We are not in the software development business, therefore, when software is needed, the first option considered should be to buy it or reuse something we already have. 2. On average, it takes less time to implement and costs less to buy or reuse software than to build it. 3. Purchased software will be maintained and updated by the vendor. Furthermore, the costs of maintenance and development are spread across a wider base.

Component	Explanation	Example
Implications	It is often apparent that current systems, standards, or practices would be incongruent with the principle upon adoption. An implication clearly states the impact to the business and consequences of adopting a principle. The reader should readily discern the answer to "how does this affect me?"	1. We will focus on end users' needs and compromise on wants in order to maximize use of packages and existing software. 2. Requirements analysis will not occur without a starting point of package software or of software currently within the infrastructure. 3. An exceptionally compelling business case is required to justify deviating from the architecture. 4. The total economic impact over the long run must be considered whether software is purchased or built.

Best Practices

The following is set of recommended architecture management best practices by Global 2000 companies for establishing a conceptual architecture. These best practices serve as design principles for the creation of the RRB's Conceptual Architecture Guidelines.

1. Eliminate duplication, incompatibility, redundancy, while taking full advantage of scalability ("economics of scale").
2. Incorporate standards that effectuate "open systems" and seamless integration and establish an enterprise-wide perspective.
3. Encourage service, application, data, and network integration across the enterprise.
4. Offer a means for stable evolution by identifying technologies that work together to satisfy the needs of customers across the organization.
5. Insure interoperability inside and outside (externalization) the organization.
6. Enable change with minimum business process disruption.
7. Support blocking of external intrusion (security)
8. Facilitate electronic alliances (e.g. Business to Business) with external and internal partners.
9. Never block or prevent a practical and/or important business initiative.

Summary of Principles

The Conceptual Architecture principles listed below and later defined in this document are mandatory for compliance. Except as indicated, the principles apply to new systems and any new development, interface, or integration of legacy systems.

Guiding Principle 1. The RRB's Enterprise Architecture is to be consistent with the Federal Enterprise Architecture.
Guiding Principle 2. All of the RRB's enterprise will support a single Enterprise Wide Technical Architecture.
Guiding Principle 3. IT projects are to be consistent with the Enterprise Architecture.
Guiding Principle 4. Business processes drive technical architectures.
Guiding Principle 5. Reduce integration complexity.
Guiding Principle 6. Technical architecture must be extensible and scalable.
Guiding Principle 7. Manage information and data as enterprise-wide assets.
Guiding Principle 8. Capture and validate information at the source.
Guiding Principle 9. Enhance the ability to capitalize on and exploit business information.
Guiding Principle 10. Support multiple data types.
Guiding Principle 11. Make an informed buy versus lease versus build decision before proceeding with any new development project.
Guiding Principle 12. Shorter development cycle times are required.
Guiding Principle 13. Keep current with emerging technologies and their applicability to enterprise architecture.
Guiding Principle 14. Maximize asset reuse.
Guiding Principle 15. Sustain reliable connectivity
Guiding Principle 16. IT systems will be implemented in adherence with the agency's security, confidentiality and privacy policies.
Guiding Principle 17. The agency will use a consistent set of security interfaces and procedures.
Guiding Principle 18. Reduce total cost of operation.
Guiding Principle 19. Extend e-mail to become a corporate information exchange vehicle.
Guiding Principle 20. Adopt open systems standards.
Guiding Principle 21. Eliminate duplicate systems.
Guiding Principle 22. Consider impact on business partners.
Guiding Principle 23. Maximize and exploit Internet and Intranet technologies and approaches.
Guiding Principle 24. Enterprise Architecture must be an integral part of the investment management process.
Guiding Principle 25. Customer satisfaction is a measure of the quality of the automation processes.

Guiding Principle 1: **Use guidelines consistent with the Federal Enterprise Architecture.**
Description: The RRB's Enterprise Wide Technical Architecture (EWTA) will be developed and maintained consistent with the guidelines established by the Federal CIO Council Information Architecture Conceptual Model. It is the Office of Enterprise Architecture's primary role
Rationale: *Adherence to this principle will enable the RRB to:* • Ensure interoperability between the departmental/agency architectures as required by the CIO Council; • Leverage opportunities to share resources with other agencies, e.g. SSA and Treasury; • Increase information and data sharing with other agencies; • Promote best practices within the RRB; and • Require that IT systems be developed and structured in a disciplined manner in accordance with the RRB's EWTA and the Federal CIO Council.
Implications: *Implications of implementing this principle:* • We must have proactive representation in the Federal CIO Council Information Architecture Group. • The RRB enterprise architecture compliance verification needs to be included in the RRB's IT review and approval processes. • Coordination needs to be done with other agency's enterprise architecture efforts. • The RRB will need to budget for Enterprise Architecture in order to achieve compliance.

Guiding Principle 2: **Support a single Enterprise Wide Technical Architecture (ETWA).**
Description: All the RRB's IT capital assets (hardware, software, licenses, interfaces, etc.) and services will exist as **one** enterprise.
Rationale: *Adherence to this principle will enable the RRB to:* • Have an agency-wide, business aligned, and integrated EWTA to help fulfill our mission; • Make consistent, rational strategic investment decisions; • Reduce long term IT costs; • Link information technology to the business functions as required by the Clinger-Cohen Act of 1996; • Provide easier accesses to enterprise data with improved quality; and • Encourage service, application, data, and network integration across the enterprise.
Implications: *Implications of implementing this principle:* • Require that the RRB budget to get all capital assets to a level that will benefit the whole enterprise. • The RRB's EWTA must be wholly accepted and followed by all of senior management. • Time and effort will be required of the RRB to continue to work towards a single enterprise. • Will require a cultural change because organizational boundaries for IT cannot exist in a single enterprise wide system.

Guiding Principle 3: **IT projects are to be consistent with the Enterprise Architecture.**
Description: All new IT systems and re-engineered systems shall be consistent with relevant legal and regulatory documents, guidelines, and plans identified in the RRB's Enterprise Architecture (EA). Relevant portions of the EA shall be used as a check-list item for compliance in IT project reviews.
Rationale: *Adherence to this principle will enable the RRB to:* • Maintain compliance with public law, directives and agency high level plans; • Establish a firm requirement for configuration management and control in a standardized fashion; • Remain business strategic based; and • Accelerate decision making.
Implications: *Implications of implementing this principle:* • All lines of management must use/be aware of EA when developing a project. • Additional resources will be required to perform compliance reviews. *Implication of not implementing this principle:* • Lack of consistent standards defeats system integration and leads to isolated products and systems.

Guiding Principle 4: **Business processes drive technical architectures.**
Description: The imperative of all major change (automation) efforts should be driven by core business rules and environment. We should never block or prevent a practical and/or important business initiative.
Rationale: *Adherence to this principle will enable the RRB to:* • Allow mission needs and priorities to drive IT investments; • Maximize the return on change efforts; • Raise the level of visibility of environmental factors to the CIO and ADP Steering Committee; • Provide the ability to conduct as much business as possible without human intervention; and • Ensure automation projects can support new business processes in addition to changing/automating current processes.
Implications: *Implications of implementing this principle:* • A process to facilitate clear and consistent communications between IT and the business must be developed and implemented. • Time and effort will be required for business process re-engineering. • The EWTA must become adequately flexible to support future business events. • Business processes will have to be documented and redesigned as part of the effort to implement consistent automated systems. • Business objectives must be well defined before initiating information technology decisions.

Guiding Principle 5:
Reduce integration complexity.

Description:
Integration complexity is reduced when all products, solutions, tools, designs, applications and methods used within the RRB's architecture are minimized and standardized.

Rationale:
Adherence to this principle will enable the RRB to:

- Use open standards-based products reducing the need to develop custom solutions to make components interoperable, thus reducing time and cost of developing and supporting new systems and upgrades.
- Reduce costs associated with help desk support, training and total cost of ownership through the reduction in the complexity of the information infrastructure.
- Provide easier information access and sharing, encouraging use of the enterprise-wide resources.
- Reduce risks associated with system implementation and upgrades.
- Make applications behave in a logically consistent manner across multiple LOB environments.
- Position itself to more easily implement IT projects;
- Decrease the number of vendors, products, and configurations in the RRB's environment; and
- Reduce costs, i.e. maintenance, training, support, etc.

Implications:
Implications if principle is implemented:

- Decrease the number of vendors, products, and configurations in your environment to enhance re-use and thereby reduce integration of new with existing systems, management, and implementation cost. This in turn will accelerate the delivery solution (time-to-value, time-to-market) of business required products and systems.
- Primary consideration must be given to products and services sourced from acknowledged strategic partners and suppliers.
- Must maintain a strict "configuration discipline", meaning standardization will take precedence over technical sophistication.
- Will sacrifice performance and functionality in some instances to achieve the highest level of reduction in complexity – reduction in complexity as a whole and specifically reduction in integration complexity must take precedence over a 100% functional fit.
- Will have to rely on "infrastructure subassemblies" supplied by vendors e.g. Data Warehouse Servers vs. generalized file servers.
- Leading edge, rather than modern but proven, technology use will have to be reduced or generally avoided if it leads to overly complex environments.

Implications if principle is not implemented:

- Business requirements challenges changes within the infrastructure to occur within the life cycle of the nature, scale and rapidity of change within the business environment, which requires solutions to be deployed fast and in near real-time fashion, that will not happen without the acceptance/enforcement of this best practice.
- Development stand-alone solutions will accelerate.
- The architecture team will have no empowerment to drive new technology deployment due to the proliferation of diverse (leading edge) deployed solutions.
- The cost of maintaining the infrastructure and subsequent solutions will outstrip the cost of deploying the solution in an estimated ratio of 1 to 7 (according to recent studies conducted by META Group's PEMS service).

Guiding Principle 6: **Technical architecture must be extensible and scalable.**
Description: The technical architecture must be extensible and scalable across the RRB's enterprise in order to achieve adaptive success. "Extensible" means the ability to easily integrate new technology and functionality. "Scalable" means the ability to quickly meet the demands for increased or decreased performance, processing power, network connectivity, or data storage.
Rationale: *Adherence to this principle will enable the RRB to:* • React to the rapid pace of new technologies; • Adapt to changing levels of railroad client bases; and • Deploy and reuse modular components.
Implications: *Implications of implementing this principle:* • Make employees more productive. • Demands for extensible and scalable systems will increase.

Guiding Principle 7:
Manage information and data as enterprise-wide assets.

Description:
The RRB program areas produce vast amounts of data that must be managed. This massive data collection effort provides the material for creating valuable information throughout the enterprise. Managing information and data as enterprise-wide assets places greater significance on cooperative strategies for satisfying the common information needs of multiple business units across the enterprise, rather than exclusively satisfying parochial component requirements.

Rationale:
Adherence to this principle will enable the RRB to:

- Foster sharing, timeliness, and integrity of information and data;
- Increase security and protection of sensitive information and data;
- Strive for universal access to all information;
- Optimize resource utilization while eliminating redundant data management costs;
- Shorten service delivery times;
- Increase the quality and consistency of data and information used to support our programs; and
- Accelerate decision making.

Implications:
Implications if principle is implemented:

- The information value chain/network must be identified and exploited.
- Data/information management must be coordinated.
- Authoritative sources (data owners) must be identified and trained on their responsibilities.
- We must accelerate the value and velocity of information (increase density and speed)
- Data needs to be restructured for easy access and management.
- An information security policy must be established with elements such as authorization and authentication
- Data quality must be auditable
- Continued stand-alone information and data.
- Collaboration, both internal and external, will be fragmented and scarce.
- Limited cross-LOB border sharing/collaboration and overload of technical infrastructure will increase the cost of implementing the right enterprise-wide infrastructure.

Guiding Principle 8:
Capture and validate information at the source.

Description:
In the design and development of IT systems, strong preferences shall be given to approaches which implement the concept of capturing, editing and correcting data as close to the original source as possible.

Rationale:
Adherence to this principle will enable the RRB to:

- Recognize that approaches that squander information and intelligence in data documents is costly;
- Recognize that scanning, conversion, and microfiche activities are time-consuming, costly, and can introduce errors that are difficult and expensive to identify and correct.
- Recognize the additional cost of maintaining/updating redundant data and databases, rather than relying on a single, authoritative source.

Implications:
Implications if principle is implemented:

- We must extend our systems to be able to capture data directly from the original source. This may involve web based or similar interfaces.
- Data from back-end databases may be needed to facilitate At-The-Source editing.
- The need to identify which current processes would benefit from this principle and decide if existing applications should be redesigned with this principle in mind.
- Back end editing and validating may need to continue depending on the sensitivity of the data.
- Design new processes with this principle in mind.

Implications if principle is not implemented:

- Data accuracy may be compromised.

Guiding Principle 9: **Enhance the ability to capitalize on and exploit business information.**
Description: Give users the ability to use technologies to efficiently capitalize on and exploit business information. An example of such a technology is datawarehousing. Datawarehousing can be used to assist in querying, reporting, planning, forecasting, structuring and making information readily available on a wide range of platforms including the web.
Rationale: *Adherence to this principle will enable the RRB to:* • Reduce development cycle times; • Accelerate decision making; • Give programmers more time for development tasks; • Gives end-users, i.e. personnel having access to the data, more access to information; and • Gives end-users the tools obtain the necessary information/reports.
Implications: *Implications of implementing this principle:* • It provides friendly end user access as well as high quality presentation capabilities and multimedia options. • End user tools must be provided. • End users will need to be trained to use the new tools and where to find the information. • The need to decide upon the location of the "centralized data" and who will be responsible for the system/information. • End users will have to specify what information they will need that doesn't already exist by some other method.

Guiding Principle 10: **Support multiple data types.**
Description: IT systems must provide the capability to support multiple forms of information beyond traditional data processing and manipulation (i.e. alpha, alpha-numeric, display numeric, and packed numeric). The IT systems must support various word processing and desktop publishing applications, still and motion imaging, voice and other sounds, and the emerging integration among these forms.
Rationale: *Adherence to this principle will enable the RRB to:* • Have greater interoperability with its "customers" and providers; • Implement projects faster; and • Give its customers a greater variety of options (e.g. remote training, e-learning, and assist in ADA and Section 508 compliance).
Implications: *Implications of implementing this principle:* • We will need to determine if data types such as voice annotation, voice recognition, full motion video, etc. are technologically feasible and demonstratable. These technologies are not necessarily proven to provide payback today. • Will need to plan for supporting multiple media in such office automation applications as image and graphics in the near term, and voice in the long term. • To be cost effective, we will need to determine which end user workstations will receive the multimedia software.

Guiding Principle 11:
Make an informed buy versus lease versus build decision before proceeding with any new development project.

Description:
The RRB should consider all cost effective technology solutions (commercial off-the-shelf, customized, or in-house) to satisfy the business and information technology requirements.

Rationale:
Adherence to this principle will enable the RRB to:

- Potentially reduce the time and expense required for researching new applications;
- Provide more focus on business issues than on technology;
- Recognize that Commercial off the shelf (COTS) implementations are generally less costly than full blown development efforts, and need to be strongly considered;
- Ensure that the development focus is on providing competitive advantage/business value; and
- Direct scarce IT resources toward projects with maximum business benefit and impact, i.e. projects that will yield business value that cannot be accomplished through a COTS alternative.

Implications:
Implications of implementing this principle:

- The RRB must establish and define evaluation criteria and the process to select applications and IT.
- The RRB should develop a solution only when no acceptable solution exists or where in-house development will save money.
- Packages should conform to defined standards for data, application, and technology models.
- Business processes may need to be adjusted to accommodate purchased applications.
- The use of commercially available add-ins to development tools can accelerate in-house development.
- Not all COTS packages are compatible with each other or with other common packages.
- Not all COTS packages fulfill the requirements for applications that support Railroad Retirement Act and Railroad Unemployment Insurance Act programs.
- Current and future IT budgets will determine whether, and how much, of COTS products we will be able to buy.
- Need to resist “customizing” COTS software to fit the RRB’s environment because total cost is not just the cost of the COTS software.

Guiding Principle 12: **Shorter development cycle times are required.**
Description: The rate of change in the business process of the organizations is accelerating. It is imperative that the RRB's development cycle be compressed to keep pace with the rapidly changing business processes.
Rationale: *Adherence to this principle will enable the RRB to:* • Respond to higher constituent expectations for customer service; • Respond to budget/appropriations initiatives which increase pressure for shorter payback periods for IT investments; • Become project focused, proactive organization; • Allow senior management decision-making to progress faster; minimizing lengthy fact gathering; and • More easily visualize integrated solutions.
Implications: *Implications of implementing this principle:* • Larger staff may be required to meet user demands. • User requirements must be clearly stated, and requirements creep must be managed throughout the development process. • Application maintainability must become a major consideration when systems are being designed. • Interfaces between systems must be standardized. • Systems will have to be built using standardized reusable components. • Requires greater specificity of business functionality to be delivered to system developers or procedures.

Guiding Principle 13:
Keep current with emerging technologies and their applicability to enterprise architecture.

Description:
Emerging technology processes will be followed to evaluate new technologies and their relevance to the business change drivers of the RRB. We should consider whether technologies be applied to fit within the "bleeding edge", "leading edge" or "mature" points on the distribution curve.

Examples of such technologies are wireless or XML.

Rationale:
Adherence to this principle will enable the RRB to:

- Understand the risk introduced by newest technologies applications;
- Enable update in data, network and system interfaces, and legacy systems without negatively impacting applications;
- Simplify creating external interfaces; and
- Make employees more productive by avoiding the "reinvention of the wheel."

Implications:
Implications of implementing this principle:

- The RRB must establish and define evaluation criteria and the process to determine what is "bleeding edge".
- Standard interfaces and protocols covering data, network, and systems need to be selected or defined.
- A testing lab to test out new hardware, software, and development tools will be required to carry out the evaluation process.
- Standard interfaces to legacy systems need to be defined, when and where necessary.
- Future applications, whether purchased or developed, will need to conform to the standards.
- As external interface standards are developed, they will need to conform to/consider industry standards.
- Obligates the replacement or upgrade of obsolete equipment in a timely manner.

Guiding Principle 14: **Maximize asset reuse.**
Description: Asset reuse means delivering reusable hardware/software infrastructure services and data to business applications.
Rationale: *Adherence to this principle will enable the RRB to:* • Redirect application developers to infrastructure development where reusable components cannot be implemented; • Spend more time on current project requirements and platforms; • Use the EWTA to guide IT toward reusable components of infrastructure; • Establish a firm requirement for re-use of IT architectural components that can meet requirement; and • Provide a mechanism for highlighting any deficiencies in the definition or implementation of common architectural components.
Implications: *Implications of implementing this principle:* • The RRB will have to establish and maintain an infrastructure development team; • The RRB will have to employ infrastructure pattern matching in infrastructure design; • Infrastructure development must provide application interface services to access reusable infrastructure components; and • Applications' technical designs must conform to the use of interface services developed by the infrastructure development team. • Many systems cannot have reusable components, but work is necessary to determine which systems can have the reusable components and should be based upon business rules.

Guiding Principle 15: **Sustain reliable connectivity.**
Description: The RRB, and the vendors the RRB contracts with, should provide the most reliable electronic connectivity between employees, customers, partners, and the enterprise information resources.
Rationale: *Adherence to this principle will enable the RRB to:* • Facilitate data access and delivery anytime, anywhere; • Support the capabilities of the RRB's Internet and Intranet, phone, etc.; • Enable new and increasing communication; and • Provide for multiple electronic input, output, and access paths to RRB services.
Implications: *Implications of implementing this principle:* • A reliable connectivity level has to be maintained both in a steady-state and as new applications are introduced. • Reliable connectivity can result in greater customer satisfaction, and reduce employee frustration and increase productivity. • High priority must be given to keeping networks in stable, reliable working order and networks must be upgraded when necessary to meet increasing business demands.

Guiding Principle 16: **IT systems will be implemented in adherence with the agency's security, confidentiality and privacy policies.**
Description: The RRB will follow its own security policies whenever developing and installing new or revised applications (built in-house or as COTS systems).
Rationale: *Adherence to this principle will enable the RRB to:* • Safeguard client information; • Enhance public trust; • Protect agency assets; and • Enable compliance with public funding requirements**.**
Implications: *Implications of implementing this principle:* • Need to identify, create, publish and keep the applicable policies current. • Need to monitor for compliance. • Make the security, confidentiality and privacy requirements clear to designers, developers, etc. • Will require the RRB to fully document/define the various types of sensitive data that must be safeguarded.

Guiding Principle 17: **The agency will use a consistent set of security interfaces and procedures.**
Description: The RRB should use security interfaces and procedures that apply to mainframe, PC, and telephonic based systems. Such interfaces and procedures are to be considered and implemented, and any interactions analyzed, at the time of development of the systems.
Rationale: *Adherence to this principle will enable the RRB to:* • Simplify use/lessens training requirements; • Perform central administration; • Protect agency assets; • Reduce integration complexity; and • Reduce costs.
Implications: *Implications of implementing this principle:* • Appropriate standards must be developed. • Need to develop a unified security mechanism. • Security requirements must be clear to designers, developers, etc. • Need to monitor compliance.

Guiding Principle 18:
Reduce total cost of operation (TCO).

Description:
Reducing the TCO means increasing the value of ownership of technology as opposed to finding a cheap technology that will lower the initial cost of operation. It is very important for the RRB not to sub-optimize the investment and just look at one of the elements when you have to look at the whole picture. The RRB should invest according to expected future requirements, and select the more powerful system solution for all needs.

Rationale:
Adherence to this principle will enable the RRB to:

- Work smarter not harder – trade capital against people costs;
- Focus on solutions with the lowest total cost over the full 'life cycle'; and
- Achieve the lowest aggregate cost to the RRB and the Federal Government.

Implications:
Implications of implementing this principle:

- To reduce support costs, we will have to re-engineer system configurations to take advantage of the dramatic improvements in the price/performance of computer technologies – MIPS, network bandwidth, memory and storage, and as a result of skill/staff shortages.
- We will need to determine if systems can ultimately live out the changes that we see coming from constituent relationship management.
- Will require a cultural change that we cannot constantly just focus on finding the cheapest solution.

Guiding Principle 19:
Extend E-Mail to Become a Corporate Information Exchange Vehicle.

Description:
Electronic mail, originally intended for quick, easy communication, is now seen by business units at the RRB as a means for exchanging critical business information either internally or externally. Messaging systems have also, unexpectedly, become key storage sites. E-mail must have a greater role in providing solutions to business needs.

Rationale:
Adherence to this principle will enable the RRB to:

- Reuse and leverage the information contained in e-mail messages;
- Expand the use of e-mail to processes other than for messaging;
- Provide solutions scalable to customer needs;
- Provide a faster solution to some business needs;
- Promotes better use of the many functions provided with the e-mail software; and
- Reduces the need for more complex solutions.

Implications:
Implications of implementing this principle:

- Current messaging systems are not designed to be permanent stores for valuable corporate information. Clumsy and ad hoc methods of retrieving stored e-mail messages:
  - diminish productivity,
  - increase the total cost of messaging system ownership,
  - raise record keeping questions under the Federal records Act, and
  - limit the deployment of corporate information assets.
- Tools will be needed to facilitate access to messaging information.
- If valuable corporate information is stored locally (on desktop hard-drives) rather than in a central archive, it may be inaccessible to others in the organization.
- Can lead to the destruction of vital business information.
- Have poor security policies and services.
- Other e-mail systems (e.g. HSL) will have to be made obsolete and their functions replaced and/or developed under the single messaging system.
- Users respond in various ways, all of which carry significant costs to retrieval systems, backups, and infrastructure.

Guiding Principle 20: **Adopt Open Systems Standards.**
Description: The RRB should consider products and technologies compliant with open system standards, and buy or develop applications that do not conflict, or are contrary to, the standards. An open system standard is best loosely defined as one for which the standard is not a secret. The description of the standard has been published or is readily available to anyone who wants to buy or build products for a hardware or software platform. This definition of an open system applies equally well to hardware and software.
Rationale: *Adherence to this principle will enable the RRB to:* • Promote interoperability; • Take advantage of lower costs resulting from vendor competition to differentiate their products within the standards framework; • Easily adapt technology solutions to satisfy changing business requirements while lowering the total cost of IT ownership; • Provide IT solutions that are less susceptible to obsolescence; • Make possible the interconnection of systems from different vendors; • Employ standards that ultimately expand our choices of technology solutions, thereby lessening our dependence on single vendor solutions; • Continue access to technological innovation supported by many customers and a broad IT industry base; and • Recognize the central importance of standards in life-cycle investment decisions.
Implications: *Implications of implementing this principle:* • Architectural components will have to be chosen with this principle in mind. • Standards will have to be reviewed often for current application to the RRB's IT environment. • Interoperability is more important than openness, however.

Guiding Principle 21: **Eliminate duplicate systems.**
Description: This principle emphasizes, unless there is a specific business need to do so, the importance of not building or maintaining systems which perform the same or related functions. Emphasis should be given to modulization of system components.
Rationale: *Adherence to this principle will enable the RRB to:* • Prevent two organizations from performing the same function using two different techniques or components; and • Use compatible methods and tools to ensure consistency of results and minimize training, maintenance, and development costs by maximizing the economies of scale.
Implications: *Implications of implementing this principle:* • When new processes or systems are rebuilt or replaced, an evaluation will need to be made as to whether this system is one that shares commonality of function with others. • If it shares sufficient commonality, the system will need to be designed with reuse in mind. This will involve gathering requirements beyond the singular elements originally targeted. • An EWTA view of functions and common processes will aid the implementation of this process. • This effort will require a larger effort but, over time, will aid the move to compatible, and thereby interoperable, systems with lower acquisition and maintenance costs in the long run.

Guiding Principle 22: **Consider impact on business partners.**
Description: Any proposed IT development activity shall consider the potential impact on the RRB's business partners (i.e. private and government) and to the maximum extent practical, secure appropriate endorsements, consensus, and support.
Rationale: *Adherence to this principle will enable the RRB to:* • Be more cognizant of its business partners; • Recognize the importance of obtaining input from business partners affected by IT development; • Recognize that the interaction of the business partner's IT systems and the RRB's IT systems are a central part of the RRB's enterprise; and • Recognize the importance of interoperability and streamlined electronic information flows.
Implications: *Implications of implementing this principle:* • Consensus among affected business partners should be achieved before moving on with a project. • Project delays may occur when obtaining endorsement, consensus, support, etc. from the business partners. • Will need to create a procedure to follow to consider other business partners prior to making changes.

Guiding Principle 23: **Maximize and exploit Internet and Intranet technologies and approaches.**
Description: Consistent with other IT architectural principles, strong preferences shall be given to IT systems which maximize and exploit Internet and Intranet technologies and approaches. A fine line must be drawn, however, that the web should only be viewed as another business tool for customers to access, not a replacement for any other means of doing business with them.
Rationale: *Adherence to this principle will enable the RRB to:* • Recognize the central role and direction of modern Internet technology as part of the global information infrastructure; • Establish acceptance and profiling of Internet-based standards recommended by various Internet standards committees; and • Comply with e-government laws and guidance.
Implications: *Implications of implementing this principle:* • Time and effort will be required to develop new or convert current paper-based processes. • Additional expertise may be needed either in training, or contract work. • E-government isn't as easy as everyone thought. • Automating a bad process doesn't make it any more efficient or effective. • Current business processes may need to be re-engineered to include the technologies.

Guiding Principle 24: **Enterprise Architecture must be an integral part of the investment management process.**
Description: For EA to be effective, it must be integrated into the RRB's Strategic and IT Capital plans. The information in the Strategic and IT Capital plans are considered essential elements of the EA, and the EA is to be considered an influencer of the Strategic and IT Capital plans.
Rationale: *Adherence to this principle will enable the RRB to:* • Recognize that these documents provide additional amplification of policies, procedures, and directives and incorporates them by reference into this higher level EA document; and • Improve decision making.
Implications: *Implications of implementing this principle:* • Increased coordination of the Executive Committee on technological, planning and investing issues affecting the enterprise architecture. • Consolidates job functions.

Guiding Principle 25:
Customer satisfaction is a measure of the quality of the automation processes.

Description:
The quality of the automation processes and services shall be measured as perceived by the "customer". The "customer" can be a railroad employee, claimant, annuitant, railroad employer, or other governmental agency (i.e. Treasury, SSA). The customer perception is to be considered with other measuring metrics.

Rationale:
Adherence to this principle will enable the RRB to:

- Measure the level of quality in its products and services in the eyes of the "customer";
- Recognize that technology is only a means to an end and that the end is the efficient and effective fulfillment of the RRB's mission; and
- Recognize "customers" as a barometer of the quality of IT services.

Implications:
Implications of implementing this principle:

- Must deliver the metrics which are meaningful in determining the quality of the system.
- Metrics must be defined and integrated into the systems' functionality.
- The customers must be fully aware of what the systems are capable of.
- The customer can only judge the automation process by ease of use and timeliness. Tracking processes will need to be developed to measure the "behind the scenes" factors that affect system quality.

Final Thoughts about Conceptual Architecture Principles

Principles are never "carved in stone". They provide guidance to our selection, creation and implementation of technical solutions. They will grow and change as the mission of the RRB changes and as new technological changes present themselves.

The Conceptual Architecture drives the design and implementation of the domain architectures and provides logical consistency across those domain architectures. The agency has identified the following eight Domain Architectures. A detailed description of the domains follows this document.